February 18, 1864.

Major-General SABINE, President, in the Chair.

The following communications were read:—

I. "A Contribution to the Minute Anatomy of the Retina of Amphibia and Reptiles." By J. W. HULKE, Esq., F.R.C.S., Assistant-Surgeon to the Middlesex and the Royal London Ophthalmic Hospitals. Communicated by W. BOWMAN, Esq. Received February 4, 1864.

(Abstract.)

The animals of which the retina was examined were the frog, the black and yellow salamander, the edible turtle, the water- and the land-tortoise, the Spanish Gecko, the blindworm, and the common snake. The method adopted was to examine the retina (where possible) immediately after decapitation of the animal, alone and with chemical agents; and to make sections of the retina hardened in alcohol or in an aqueous solution of chromic acid, staining them with iodine or carmine, and adding glycerine, pure and diluted, to make them transparent. The following is a summary of the results of the examination.

1. The rods and cones consist of two segments, the union of which is marked by a bright transverse line.

2. Each segment consists of a membranous sheath and contents.

3. The outer segment, or *shaft*, is a long narrow rectangle (by inference, a prism or cylinder). It refracts more highly than the inner segment. Its contents are structureless, and of an albuminous nature. It is that part which is commonly known as "*the rod.*" It is smaller in the cones than in the rods, and in the cones narrows slightly outwards.

4. The outer ends of the shafts rest upon the inner surface of the choroid, and their sides are separated by pigmented processes, prolonged from the inner surface of the choroid between them to the line that marks the union of the shaft with the inner segment. The effect of this is that the shafts are completely insulated, and rays entering one shaft are prevented passing out of it into neighbouring shafts.

5. The inner segment of the rods and cones, or body (the appendage of some microscopists), has a generally flask-shaped form, longer and more tapering in the rods, shorter and stouter in the cones. It is much paler and less conspicuous than the shaft. It fits in an aperture in the membrana limitans externa.

Its inner end always encloses, or is connected by an intermediate band with an outer granule which lies in or below the level of the membrana limitans externa. Its outer end, in cones only, contains a spherical bead nearly colourless in the frog and blindworm, brilliantly coloured in the turtle and water- and land-tortoises, and absent from the common snake and Spanish Gecko. In addition to this bead, where present, and the outer gra-

nule, the body contains an albuminous substance which in chromic acid preparations retires as an opaque granular mass towards the outer end of the body. The inner end of the body is prolonged inwards, in the form of a pale, delicate fibre, which was sometimes followed through the layer of inner granules into the granular layer. It does not appear to be structurally connected with the inner granules. It is essentially distinct from Müller's radial fibres, and bears a considerable resemblance to the axis-cylinder of nerve. That it *ever* proceeds from the outer granule associated with the rod- or cone-body is doubtful, from the consideration (α) that where the body is large, and the granule lies within at some distance from its contour, the fibre is seen to leave the inner end of the body distinct from the granule, and (β) that the fibre appears to proceed from the outer granule only where the body is small, as in the frog, and where the granule does not lie within the body but is joined to this by a band. Ritter's axial fibres are artificial products.

6. The "outer granules" are large, circular, nucleated cells. Each cell is so intimately associated with a rod- or cone-body that it forms an integral part of it.

7. The intergranular layer is a web of connective fibre. It contains nuclei.

8. The inner granules are roundish, in chromic acid preparations polygonal cells. They differ from the outer granules by their higher refraction, by the absence of a nucleus, and by receiving a deeper stain from carmine. They lie in areolæ of connective tissue derived from Müller's radial fibres, and from the intergranular and granular layer. They are more numerous than the outer granules, and consequently than the rods and cones.

9. The granular layer is a very close fibrous web derived in part from Müller's radial fibres, and from other fibres proceeding from the connective frame of the layer of inner granules. It transmits (α) the radial fibres, (β) fibres proceeding radially outwards from the ganglion-cells and bundles of optic nerve-fibres, and (γ) fibres passing inwards from the rod- and cone-bodies.

10. The ganglion-cells communicate by axis-cylinder-like fibres with the bundles of optic nerve-fibres, and send similar fibres outwards, which have been traced some distance in the granular layer.

11. In the frog and Spanish Gecko the author has a few times traced fibres proceeding from the bundles of optic nerve-fibres for some distance in a radial direction in the granular layer.

12. Müller's radial fibres arise by expanded roots at the outer surface of the membrana limitans interna, pass radially through the layers, contributing in their course to the granular layer, to the areolar frame of the layer of inner granules, and end in the intergranular layer and at the inner surface of the membrana limitans externa. They are a connective and not a nervous tissue, and do not communicate between the basilary element and ganglion-cells.

13. The orderly arrangement of the several layers and their elementary parts is maintained by a frame of connective tissue which consists of—1, an unbroken homogeneous membrane bounding the inner surface of the retina, the membrana limitans interna; 2, a fenestrated membrane which holds the rods and cone-bodies, the membrana limitans externa, first correctly described by Schultze; 3, an intermediate system of tie-fibres—Müller's radial fibres—connected with which in the layer of inner granules are certain oblong and fusiform bodies of uncertain nature; 4, the intergranular layer; 5, an areolated tissue, open in the layers of outer and inner granules, and very closely woven in the granular layer.

14. No blood-vessels occur in the reptilian retina.

II. "Notes of Researches on the Acids of the Lactic Series.—No. I. Action of Zinc upon a mixture of the Iodide and Oxalate of Methyl." By E. Frankland, F.R.S., Professor of Chemistry, Royal Institution, and B. F. Duppa, Esq. Received February 10, 1864.

In a former communication by one of us*, a process was described by which leucic acid was obtained synthetically by the substitution of one atom of oxygen in oxalic acid by two atoms of ethyl.

The relations of these acids to each other will be seen from the following formulæ†:—

$$\underbrace{C_2''' \begin{cases} O \\ O \\ O\,H \\ O\,H \end{cases}}_{\text{Oxalic acid.}} \qquad \underbrace{C_2' \begin{cases} C_2\,H_5 \\ C_2\,H_5 \\ O \\ O\,H \\ O\,H \end{cases}}_{\text{Leucic acid.}}$$

This substitution of ethyl for oxygen was effected by acting upon oxalic ether with zincethyl. On distilling the product with water, leucic ether came over, which on treatment with an alkali yielded a salt of leucic acid.

We have since found that this process may be much simplified by generating the zincethyl during the reaction, which is effected by heating a mixture of amalgamated zinc, iodide of ethyl, and oxalic ether in equivalent proportions to the necessary temperature.

The operation may be considered complete when the mixture has solidified to a resinous-looking mass. This, treated with water as in the former reaction and distilled, produces quantities of leucic ether considerably greater than can be obtained from the same materials by the first mode of operating. Thus the necessity for the production of zincethyl is entirely obviated, the whole operation proceeds at the ordinary atmospheric pressure, and a larger product is obtained.

We find that this process is also applicable to the homologous reactions with the oxalates and iodides of methyl and amyl. By it we have obtained

* Proceedings of the Royal Society, vol. xii. p. 396.

† The atomic weights used in this paper are the following:—$C=12$, $O=16$ and $Zn=65$.